Subject card

Subject name and code	Modern Technics in NMR Investigations, PG_00182185		
Field of study	Medical Physics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	2.0
Learning profile	academic	Assessment form	exam
Conducting unit	Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Małgorzata Grzywińska	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	30	0.0	30.0	60

Subject objectives
1. To familiarize students with new diagnostic capabilities of Magnetic Resonance (MR), such as diffusion imaging, tractography, spectroscopy, tissue perfusion, functional brain imaging, and dynamic studies of various organs. 2. To make students aware of the image formation principles in specific modern MR techniques and the potential causes of artifacts. 3. To teach students the fundamentals of processing spectroscopic, tractographic, and perfusion MR examinations, as well as performing subtraction for dynamic studies after contrast agent administration.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[FIZMEDMU2_W06] Knows and understands the current directions of development of physics and medical sciences, especially in the field of medical physics, and the fundamental dilemmas of modern civilisation.	The student knows and understands advanced magnetic resonance imaging techniques such as diffusion-weighted imaging, spectroscopy, and tractography, as well as their importance for the development of medical diagnostics. They understand how modern MR techniques, such as functional brain imaging or dynamic organ studies (heart, liver, prostate), address the fundamental diagnostic dilemmas of modern medicine.	[SW4] test/exam - oral or written
	[FIZMEDMU2_W04] Knows and understands in depth the theoretical foundations and principles of operation of measurement systems and research, diagnostic and therapeutic equipment specific to the field of physics and medicine.	The student knows and understands the theoretical principles of image formation in specific, modern magnetic resonance techniques and can explain the causes of artifacts. They know and understand the operating principles of MR equipment and know how its parameters affect the quality of diffusion, perfusion, or spectroscopy imaging.	[SW4] test/exam - oral or written
	[FIZMEDMU2_W01] Knows and understands in depth selected issues in the field of physics and medicine, the complex relationships between them, and development trends in the exact and natural sciences, health sciences, and others.	The student understands the complex relationships between the physical principles of MR and its clinical applications, such as in dynamic organ studies following contrast agent administration. They are familiar with the methodology for performing advanced MR studies, including their indications and contraindications. They understand the prospects and development directions of modern imaging techniques and know how to compare conventional MR methods with functional imaging.	[SW4] test/exam - oral or written
	[FIZMEDMU2_K04] He is ready to take care of the achievements and traditions of the medical physicist profession by improving his competencies and popularising knowledge.	The student is ready to continuously improve their skills by following the latest developments in modern MR techniques and their clinical applications. They demonstrate a proactive attitude in popularizing knowledge about modern diagnostic methods and their capabilities, for example, by discussing clinical cases where the use of advanced MR has changed therapeutic management. They are ready to uphold the traditions of the medical physicist profession through a professional approach to their duties, including preparing study reports and ensuring workplace safety within a multidisciplinary team.	[SK4] test/exam - oral or written

<table>
<tr><td>Subject contents</td><td>This course presents the advanced diagnostic capabilities of Magnetic Resonance (MR) imaging. The topics include diffusion-weighted imaging, tractography, spectroscopy, tissue perfusion, functional brain imaging, and dynamic studies of the liver, prostate, heart, breasts, and pancreas. It also covers studies following intravenous administration of contrast agents, with a focus on tissue-specific agents.

We will discuss the methodology of each technique, including their indications and contraindications, the main benefits of their use, and the potential causes of artifacts. The utility of tissue-specific contrast agents will also be covered.

Clinical case studies will be presented to illustrate how the application of modern MR imaging has changed therapeutic management. We will also discuss how a medical physicist processes these studies. We'll highlight the specific role and tasks of the medical physicist within the multidisciplinary team of an MR department.

The course will compare conventional MR imaging with functional imaging, analyze the future prospects of these techniques, and discuss how a medical physicist creates reports for functional studies and ensures workplace safety.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>exam</td><td>51.0%</td><td>100.0%</td></tr>
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<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>not applicable</td></tr>
<tr><td>Supplementary literature</td><td>not applicable</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">not applicable</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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